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A REDESCRIPTION OF *CHRYSSO NIGRICEPS* (ARANEAE, THERIDIIDAE) WITH EVIDENCE FOR MATERNAL CARE

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ABSTRACT. *Chrysso nigriceps* is redescribed and the male is described for the first time based on material from Colombia. Evidence for maternal care of juveniles in *Chrysso* is presented. This evidence is consistent with predictions based on phylogenetic analysis that maternal care is primitively present in the lost colulus clade, the lineage containing all social theridiids.

Keywords: *Chrysso*, evolution of sociality, maternal care, taxonomy, South America

Chrysso nigriceps (Keyserling 1884) was described based on a female specimen from Colombia. In a revision of *Chrysso* O. Pickard-Cambridge 1882 from the Americas, Levi (1957) redescribed the female, but to date the male remains unknown. Here we redescribe *C. nigriceps* and provide a description of the male. We observed juveniles of *C. nigriceps* cohabitating in the female web (Fig. 1), suggesting some degree of maternal care. Kuntner (pers. comm.) also observed juveniles in adult webs of an Indonesian species, *Chrysso* nr. *argyrodiformis* (Yaginuma 1952). To our knowledge, these observations represent the first evidence of maternal care of juveniles reported in *Chrysso*. Although preliminary, our evidence for maternal care in *Chrysso* is consistent with Agnarsson's (2004) phylogenetic conclusion that maternal care is primitively present in the subfamily Theridiinae.

A growing body of evidence supports the "maternal care route" hypothesis to web sharing sociality (Avilés 1997; Agnarsson 2002, 2004). It states that social behavior evolved via temporal extension of maternal care (see Kullmann 1972; Avilés 1997 for reviews). Tolerance among juveniles is maintained over an increasing period of their life-span, culminating in permanent web sharing sociality (quasisociality) with extensive cooperation among adults. The optimization of maternal care (or simply the brief coexistence of mother and young in the web) on a phylogenetic tree is therefore an important step in reconstructing the evolutionary path from solitary to social lifestyle.

Agnarsson (2002, 2004) discussed the progression from solitary lifestyle to quasisociality in a phylogenetic context. In his phylogeny, maternal care optimized to the node leading to all instances of sociality (*Anelosimus* Simon 1891 plus Theridiinae, or the "lost colulus clade", see Agnarsson 2004, fig. 106). Based on this, he predicted that maternal care should be widespread within the lost colulus clade, a lineage containing hundreds of species. However, Agnarsson (2004) pointed out that the lack of behavioral data on many key taxa in the analysis limited the power of this argument. He noted that the lack of evidence for maternal care in many of these species is due to a poverty of studies on lost colulus clade species that might have discovered maternal care in the field, rather than failed attempts to document maternal care. Agnarsson's (2004) phylogeny of theridiid genera places *Chrysso* (based on an undescribed species called *Chrysso* nr. *nigriceps*) in a key phylogenetic position, sister to the remaining theridiines. *Chrysso* was scored as unknown for maternal care, as were several other basal theridiines. Evidence for maternal care in *Chrysso* corroborates the hypothesis that maternal care is primitively present in the lost colulus clade, and that maternal care precedes sociality in evolutionary time. Note that a mo-

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lecular phylogeny of theridiids places *Chrysso* nr. *nigriceps* in a clade with *Helvibis* Keyserling 1884 and *Theridula* Emerton 1882, together sister to the remaining theridiines (Arnedo et al. 2004). Maternal behavior remains to be documented for *Helvibis* and *Theridula* and this alternative placement of *Chrysso* does not alter the significance of our finding.

METHODS

Illustrations were modified from digital photographs taken using a Nikon DXM 1200 digital camera mounted on a Leica MZ16 A dissecting microscope. All measurements are in millimeters and were taken using a reticle in a LEICA MZ APO dissecting microscope. For further details on methods see Miller (in press) and Agnarsson (2004). Material used in this study was borrowed from the following institutions: The Natural History Museum, London (BMNH), Museum of Comparative Zoology, Harvard (MCZ), and National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM).

TAXONOMY

Family Theridiidae Sundevall 1833
Genus *Chrysso* O. Pickard-Cambridge 1882
Chrysso nigriceps Keyserling 1884
Figs. 1–6

Chrysso nigriceps Keyserling 1884: 154, pl. 7, fig. 95 [♀]; Levi 1957: 65, figs. 16, 32, 33 [♀]; Platnick 2004. Holotype female from Bogotá, Colombia, in BMNH, examined.

Theridion keyserlingi Petrunkevitch 1911: 198 (unjustified replacement name for *C. nigriceps*; see Levi 1957; Platnick 2004); Mello-Leitão 1941: 250; Roewer 1942: 494.

Type material.—Holotype female: COLOMBIA: *Cundinamarca*: Bogotá, Keyserling (BMNH, BM1890.7.1.8150).

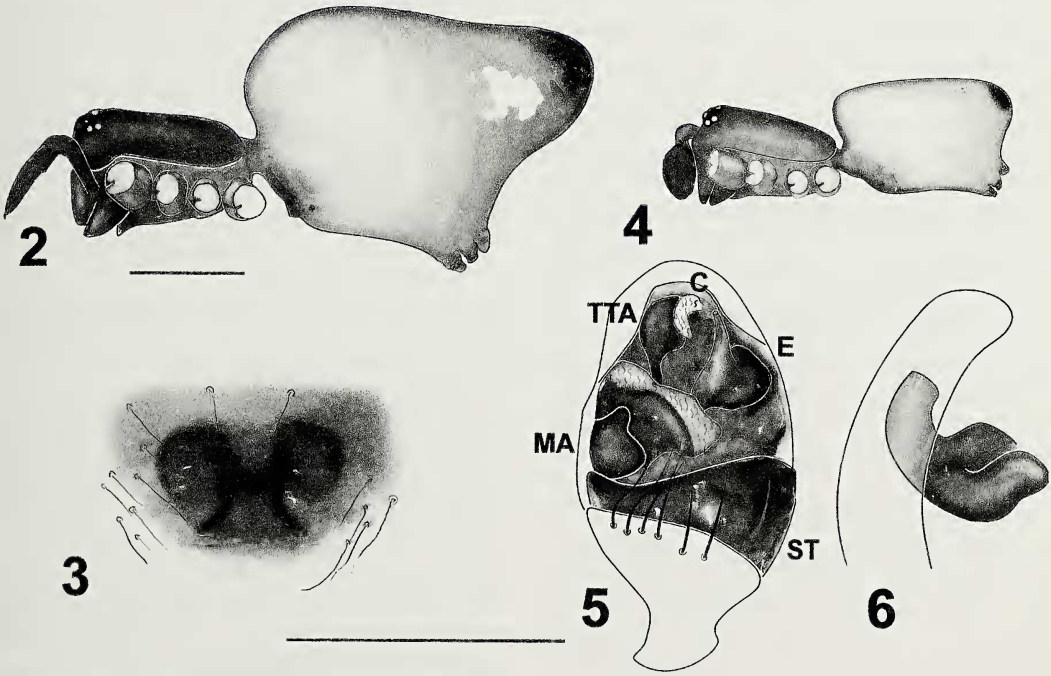
Other material examined.—COLOMBIA: *Cundinamarca*: Silvania, Res. Agua Bonita (off Carretera Sibate—Fusagasugá; 15 km from Sibate), 4°26′N, 74°20′W, 2440–2560 m, 1 February 1998, G. Hormiga (USNM), 1 ♀; same data, J. Miller (USNM), 1 ♀; La Calera, Cerro del Chocolatero, ca. 5 km NE of Bogotá, 4°42′N, 73°58′W, 3000–3145 m, 31 January 1998, G. Hormiga, J. Miller, J. Barriga, J.C. Bello, A. Sabagal (USNM), 1♀; *Valle del Cauca*: Yotoco, 1600 m, December 1976, W. Eberhard (MCZ, det. B. Opell), 2 ♂, 1 ♀, 1 juvenile ♂; Saladito above Cali, 1800 m, 3 January 1977, fog forest, H. Levi (MCZ, 57413), 1 ♀; arriba de Saladito, 1800 m (MCZ, 57412), 5 ♀, 3 egg cases; Saladito, 1800 m, 20 March 1970 (MCZ, 57417, det. Levi), 1 ♀; Saladito, 1800 m [no date] (MCZ, 57411), 1 ♀, eggs and embryonic juveniles; near Saladito, 12 October [no year] (MCZ, 57418), 4 ♀, eggs and embryonic juveniles; Cali [no date] (MCZ, 57414), 1 ♂; near Pance, P.N.N. Farallones de Cali, Res. Nat. Hato Viejo, 3°20′53″N, 76°40′07″W, 2300 m, 12 February 1998, G. Hormiga (USNM), 1 ♂; *Putumayo*: Cauda-Putumayo, road between Mocoa and Silbundoy, ca. 71,500 m [*sic*], August 1973, W. Eberhard (MCZ, 57416, det. Levi), 1 ♀.

Additional records.—ECUADOR: Bañor, Runtun Trail, 2000 m, 26 November 1939, F. M. Brown, 1 ♀ (see Levi 1957).

Diagnosis.—*Chrysso nigriceps* differs from most American *Chrysso* by the coloration of the abdomen, bright orange (light gray in alcohol) with black posterior lobe (Figs. 1, 2 & 4). Females further differ by the presence of a trapezoidal plate on the posterior margin of the epigynum (Fig. 3). Males can be diagnosed by the shape of the median apophysis in prolateral view (Fig. 6).

Description.—*Female (from Agua Bonita, Cundinamarca, Colombia):* Total length 4.40, carapace length 1.55, carapace width 1.29, sternum length 0.88, sternum width 0.87. Carapace dusky orange, darker around eyes. Sternum orange. Chelicerae orange with two promarginal teeth. Palpi dusky orange; palpal tibia with one prolateral, one retrolateral trichobothrium. Coxae, trochanters, and basal half of femora orange; distal half of femora and distal leg segments dusky orange. Leg I: femur 2.71, patella 0.58, tibia 1.85, metatarsus 2.02, tarsus 0.95, total 8.12; leg II: femur 1.87, patella 0.50, tibia 1.09 metatarsus 1.20, tarsus 0.73, total 5.40; leg III: femur 1.28, patella 0.42, tibia 0.70, metatarsus 0.78, tarsus 0.58, total 3.76; leg IV: femur 2.22, patella 0.51, tibia 1.40, metatarsus 1.33, tarsus 0.69, total 6.14. Leg formula: 1-4-2-3. Abdomen extends posteriorly beyond spinnerets, bright orange (light gray in alcohol) with black posterior tip and two white guanine patches, posterior patch larger than anterior (Figs. 1, 2). Colulus absent. Area between booklungs covered with smooth orange sternite continuous with epigynum; spermathecae separated by less than their width; epigynum with median trapezoidal plate at posterior margin (Fig. 3).

Figure 1.—*Chrysso nigriceps*. Juvenile spiders in web with adult female, Agua Bonita, Colombia.



Figures 2–6.—*Chrysso nigriceps*. 2, 3. female; 4–6. male. 2, 4. habitus, lateral view; 3. epigynum; 5. male palp, ventral view; 6. median apophysis, prolateral view. C, conductor, E, embolus, MA, median apophysis, ST, subtegulum, TTA, theridiid tegular apophysis. Upper scale bar for Figs. 2 & 4, 1 mm; lower scale bar for other figures, 0.5 mm.

Male (from Hato Viejo, Valle del Cauca, Colombia): Total length 2.77, carapace length 1.21, carapace width 1.06, sternum length 0.73, sternum width 0.70. Carapace orange. Sternum orange. Chelicerae orange with two promarginal teeth. Palpi dusky orange. Coxae, trochanters, and basal half of femora orange; distal half of femora and distal leg segments dusky orange. Leg I: femur 2.43, patella 0.49, tibia 1.76, metatarsus 1.83, tarsus 0.91, total 7.41; leg II: femur 1.65, patella 0.37, tibia 1.02, metatarsus 1.09, tarsus 0.66, total 4.78; leg III: femur 1.18, patella 0.33, tibia 0.69, metatarsus 0.73, tarsus 0.51, total 3.43; leg IV: femur 1.97, patella 0.41, tibia 1.28, metatarsus 1.24, tarsus 0.66, total 5.56. Leg formula: 1-4-2-3. Abdomen extends posteriorly slightly beyond spinnerets, light gray (in alcohol) with black posterior tip; guanine patches absent (Fig. 4). Colulus absent. Area between book-lungs covered with smooth orange sternite. Palp as in Fig. 5; median apophysis diagnostic (Fig. 6).

Distribution.—Colombia and Ecuador.

Remarks.—During an expedition to Colombia, *Chrysso nigriceps* was collected from two regions, the male from near Cali, females near Bogotá. An undescribed *Chrysso* species was also collected on this same expedition. Both males and females of this undescribed species were collected from the S.F.F. Iguaqué, Boyocá, Colombia. The undescribed species was included as the exemplar representing *Chrysso* in recent phylogenetic analyses of theridiid genera, where it was referred to as *Chrysso* nr. *nigriceps* (Agnarsson 2004; Arnedo et al. 2004).

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LITERATURE CITED

Agnarsson, I. 2002. On the relation of sociality and kleptoparasitism in theridiid spiders (Theridiidae, Araneae). Journal of Arachnology 30:181–188.

Agnarsson, I. 2004. Morphological phylogeny of cobweb spiders and their relatives (Araneae, Araneoidea, Theridiidae). Zoological Journal of the Linnean Society 141:447–626.

Arnedo, M.A., J. Coddington, I. Agnarsson, & R.G. Gillespie. 2004. From a comb to a tree: Phylogenetic relationships of the comb-footed spiders (Araneae, Theridiidae) inferred from nuclear and mitochondrial genes. Molecular Phylogenetics and Evolution. 31:225–245.

Avilés, L. 1997. Causes and consequences of cooperation and permanent-sociality in spiders. Pp. 476–498. *In* The Evolution of Social Insects and Arachnids. (J.C. Choe & B.J. Crespi, eds.) Cambridge University Press, Cambridge.

Keyserling, E. 1884. Die Spinnen Amerikas. II. Theridiidae. Nürnberg 1, 222 pp.

Kullmann, E. 1972. Evolution of social behavior in spiders (Araneae; Eresidae and Theridiidae). American Zoologist 12:419–426.

Levi, H.W. 1957. The spider genera *Chrysso* and *Tidarren* in America (Araneae: Theridiidae). Journal of the New York Entomological Society 63:59–81. [Date on volume 1955; actually published in 1957.]

Mello-Leitão, C.F. de. 1941. Catalogo das aranhas da Colombia. Anais Academia brasileira de Ciencias 13:233–300.

Miller, J.A. In press. Review of erigonine spider genera in the Neotropics (Araneae: Linyphiidae, Erigoninae). Zoological Journal of the Linnean Society.

Petrunkevitch A. 1911. A synonymic index-catalogue of spiders of North, Central and South America with all adjacent islands, Greenland, Bermuda, West Indies, Terra del Fuego, Galapagos, etc. Bulletin of the American Museum of Natural History 29:1–791.

Platnick, N.I. 2004. The world spider catalog, version 4.5. American Museum of Natural History, online at http://research.amnh.org/entomology/spiders/catalog/index.html

Roewer, C. F. 1942. Katalog der Araneae von 1758 bis 1940. Bremen, 1:1–1040.

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